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Cover: As computerized sales and accounting systems become more and more visible in the marketplace, consumers are having to come to terms with the machines. For information on how these new computer systems work, see story beginning on page 3.

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The Consumer Comes Face to Face with the Computer

*by Zane Thornton**

THE relationship between the consumer and the computer has never been an easy one. A few years ago, the computer was consigned to the backroom of business. There, behind the scenes, cloaked in mystery and anonymity, it was a perfect scapegoat—the foil for human errors in billing statements, lost orders, troubles at the bank, welfare overpayments, and misplaced records. The consumer, in other words, has been conditioned to mistrust the "machine."

Today, the computer is moving out of the backroom to meet the consumer at the point where money is exchanged for goods and services. Three new types of computer-based systems are on the way: the department store electronic point-of-sale terminal, the supermarket automated check-out counter, and the bank electronic funds transfer systems. This journey has already produced some turbulent moments, and there may be more before the "bugs" are ironed out and shoppers gain enough understanding to be comfortable with this kind of automation.

In addition to consumers, the characters in the scenario include retailers, bankers, unions, legislators, regulatory agencies, merchandise manufacturers, and a variety of trade associations. New or continuing

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The receipt tape for this point-of-sale terminal lists the style, vendor, season, and color of each item in addition to the price.

* Zane Thornton is deputy director of the NBS Institute for Computer Sciences and Technology.

skirmishes are likely to concern such issues as price marking, labor displacement, privacy, banking policy, and competition and antitrust.

Minor Problems

The full impact of the large problems is yet to be felt. But less-serious factors, such as "premature" use of computer-based systems in the retail environment, can also lead to consumer dissatisfaction. A relatively minor but still irritating example occurs daily in many department stores.

Customers queue up in the aisle as a cashier hovers over a computer-based console, laboriously punching buttons. This console is an electronic point-of-sale (POS) terminal, part of a larger computer system that has replaced the conventional electromechanical cash register. It is capable of speeding up the sale considerably; estimates indicate, in fact, that it can handle the transaction two or three times as fast as the conventional cash register. Why, then, the bottleneck?

Actually the customer is experiencing the growing pains associated with the introduction of new technology. If shoppers queue up, it may mean that the terminal has been installed on the sales floor before there is any capability to use it in its intended fully automated mode. In the manual mode, it is a clumsy replacement for the cash register. But once the merchandise is properly marked and the system fully automated, resemblance to the cash register diminishes and benefits become more apparent. Then labels can be read automatically by an optical character recognition (OCR) scanner/reader, called a wand, and the POS terminal can perform the two basic functions it is intended for:

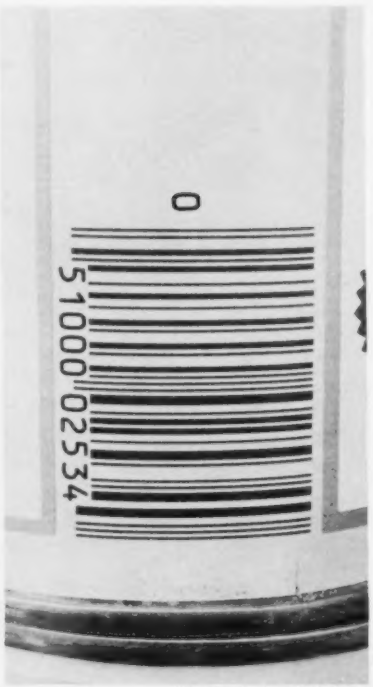
- It can execute the sales transaction for the customer.
- It can automatically collect a wide variety of merchandising information and make it immediately available to management for use in such merchandise control functions as inventory control, re-order, credit billing, and sales analysis.

Customer's Point of View

From the customer's point of view, shopping in a POS-equipped department store should not vary greatly from the past—except that the shopper may spend less time at the checkout counter and encounter fewer "out-of-stock" frustrations. Once merchandise selections have been made and taken to the cashier counter, the sales clerk will pass a handheld wand over the lines of print on the label, the data from the ticket will be stored in the POS system, and the terminal will print a sales ticket and automatically calculate taxes and discounts.

If the purchases are to be paid for by credit card, the clerk may insert the customer's card into the terminal at the start of the transaction and have the credit authorization verified while the rest of the transaction is being completed. Again, all this may take place two or three times as fast as with a conventional cash register.

What the customer sees at the cashier counter is only the tip of the iceberg. POS systems will be hard at work behind the scenes in a merchandise control chain that stretches from the department store to the plant where merchandise is manufactured. The end effects of this new form of automation should be more effective management of retailing and better quality service to the consumer. The store manager can do a better job of serving the customer because he will have rapid access to more accurate and timely data from the sales floor.



(Photos by Mark Helfer.)

Standards

The National Bureau of Standards has played an important role in helping bring about this latest automation in the retail industry. The Bureau provided technical advice and assistance to the National Retail Merchants Association (NRMA), a trade association representing more than

The wand automatically "reads" the price tag, and transmits the information to the point-of-sale terminal, where it is displayed and printed. The POS terminal can be connected directly to a computer or can store the data for later computer processing.

The supermarket industry expects to achieve maximum savings from the computerized system by posting the price on the shelf under the product and eliminating individual pricing. Consumer groups believe that elimination of item pricing will make it much more difficult for shoppers to compare prices of various products.

The Universal Price Code symbol identifies the manufacturer and the product by a numerical code. The store computer has information on the price and inventory of each item in its memory, ready to be used by the POS terminal.

30,000 department, specialty, and variety stores, in developing its Voluntary Retail Identification Standard for labeling merchandise in a way that can be read automatically by an OCR scanner/reader. In addition, the NRMA has made available to its members NBS-produced computer security guidelines and procedures for safeguarding individual privacy.

Industry-wide standards are crucial to the new breed of automated system; without such standards, the systems cannot be made to operate economically. The retail industry spent some 6 years developing its voluntary retail identification standard.

The grocery industry is another recent "convert" to the kind of automation technology that deals directly with the consumer. It spent 3 years in developing its standard labelling code, called the Universal Product Code (UPC). To the consumer there is a very obvious and important difference between the retail industry's code and the UPC—price marking.

The machine-readable department store merchandise identification label displays the price of the items in human-readable, dollars-and-cents form. The department store customer should notice little difference between the new and old labels except that the numbers and letters on the machine-readable labels are in an Optical Character Recognition (OCR) type font. OCR markings are as easy to read as are the conventional printed or typed characters.

UPC Code

The "priceless" UPC symbol, in its basic form, is made up of a bar-

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code arrangement that represents 10 digits. The first five digits identify the manufacturer of the product on which the symbol appears. For example, 18000XXXXX identifies the Pillsbury Company, and 24000XXXXX identifies the Del Monte Corporation. The second five digits identify the product, for instance XXXXX18238 identifies an 8 ounce box of Rice Chex.

In addition to the UPC, the supermarket system has two other main components: the check stand with its automatic reader and point-of-sale terminal and a small backroom computer that contains a directory of applicable UPC numbers, the prices associated with each number represented by the bar-code symbol on each item, and a memory for storing transaction data.

Automated Supermarket

What can people expect in the automated supermarket? The shopper will select items much the same as she does now except that about 75 percent of the merchandise will be marked with the UPC symbol but not the price; instead, a label on the shelf will show the unit price. At the checkout counter, the clerk will orient each item on the conveyor belt so that the UPC symbol passes directly over a scanner under the checkstand. The scanner will read the symbol and convert it to digits that are then transmitted to the back room computer, where the incoming ten-digit is located in the computer's directory of UPC numbers and prices.

The computer will pick off the price corresponding to the incoming UPC number and transmit the price back to the checkstand where it will appear on a screen atop the terminal. Simultaneously, the price will trigger a printer within the terminal that prints an entry on the sales tape. When the last item has been scanned, the terminal will total the bill, compute applicable taxes, and figure the amount of change due the customer. Those responsible for the automated supermarket system estimate that the automated checkstand operates about two-thirds faster than the conventional manual checkstand.

Battle Lines Drawn

When the grocery industry announced its plans to change to widespread use of automated checkstands and the priceless UPC, consumers drew the battle line. Some groups declared that they would boycott supermarkets that used the computerized system which would remove the dollars-and-cents label from grocery products. The Subcommittee for Consumers of the U.S. Senate Commerce Committee held a symposium on December 11, 1974, to obtain information and advice about the UPC. At that symposium, an industry spokesman gave the following explanation:

"Item price marking is estimated to cost approximately $1 per thousand items marked and item repricing approximately $3 per thousand items marked. Thus, current item pricing and repricing practices add between $250 million and $300 million annually to food distributions costs (for non-variable weight items). On an individual store basis, this works out to about $8,000 per year in a $60,000 per week supermarket (at 1973 wage rates). The total so-called "hard" net benefits of an automated checkstand installation in such a store has been estimated at approximately $35,000 annually. Duplicate item marking (UPC plus dollars and cents) would, therefore, reduce this to about $27,000 annually."

Benefits to Consumer?

The grocery industry has been fairly cautious in stating the benefits that will accrue to the consumer as a result of the UPC and the automated checkstand. The question of pass-through of cost savings to the customer in the form of lower prices has been particularly nebulous. For example, in the presentation to the Senate Subcommittee a spokesman provided a list of "possible benefits" one of which was "Lower prices (?)". The spokesman went on to say, "The question mark is that we know if our projections are right the cost of handling grocery products will be lower. There is no law, however, that says a retailer must reflect lower costs in lower prices. However, there is clearly the potential for lower prices to the extent that the retailer takes the lower costs and reflects them." More recently, the grocery industry has adopted the statement, "opportunity for lower prices."

Other "possible benefits" include greater accuracy in pricing, quicker checkout, more informative sales receipts, fewer out-of-stock items through better inventory control, and no need to separate multiple price items. (For example, three items priced at 3 for $.37 can be separated and passed over the scanner interspersed with other items and the computer will keep track of them and tally them on the tape at the price of $.37).

Computer sales systems in department stores as well as supermarkets can reduce labor costs by providing continuous inventory and sales data for each item.

(Photos by Mark Helfer.)

Other Benefits to Industry

One of the perceived benefits to industry at the retail level is "improved labor productivity," as reported to the Subcommittee. This benefit is made up of several parts: (1) checker productivity is expected to increase because the automated system will reduce the amount of labor required per dollar of sales; (2) because items will be UPC source marked at the point of manufacturer, the amount of labor required for in-store price marking or remarking will be reduced; (3) reorder labor will be reduced because the automated system will provide continuous, accurate inventory and item movement data; and (4) checker training will require less time.

In addition to expected labor productivity benefits, the industry also expects to benefit from a reduction in mis-rings or the number of mistakes made by the checker; shorter period of time for recapping transactions at the end of the day; and more timely and comprehensive information to assist the store manager in making decisions on price, inventory control, and space allocation.

More Consumer Concerns

Although the absence of dollars-and-cents price marking on individual items has been a large part of the UPC controversy, there are indications that other difficult issues remain. Ms. Ellen Zawel, President of the National Consumer Congress, alluded to some of these issues before the Subcommittee for Consumers when she said, "Do you realize all the social impact questions that this system has raised have never been addressed by the people who are concerned about bringing this system into the market-place? . . . You have not dealt with it from the marketing level to the consumer, you haven't dealt with the implications of privacy, of having data consumption patterns, particularly in a world where you have food stamps."

Ms. Zawel has probably hit upon the single most important reason that detente between consumer and this area of automation and technology has not yet been reached—in spite of increasing supermarket check-out automation. Very simply, the new breed of computer systems for direct or unbuffered interaction with the consumer require special consideration in their design and implementation. System designers have to give a great deal more thought to consumer habit and behavior and to the tradeoffs between what is technically satisfying to the system engineer and what degree of change the consumer will accept. In short, the system designer cannot afford to go about his job in splendid isolation. He would be well advised to invite the consumer into his laboratory early in the design process.

As Carol Foreman, Executive Director of the Consumer Federation of America, observed, "The source marking of the UPC is something perhaps the consumers and labor should have had an input to, but have not had, and that time is past."

Next month in DIMENSIONS/NBS, Thornton will discuss another aspect of consumer-computer encounter: the transfer of money by electronic means and the maze of financial, regulatory, and technological issues in a "less-cash, less-check society."□

Is This Slip Necessary?

IT happens quicker than you can say "kinesiology," "anthropometry," or "coefficient of friction."

Eight million Americans slip and fall in their homes each year. Nearly 10,000 die as a result. More than 1½ million suffer disabling injuries. Numerous others learn the hard way that many roads really are SLIPPERY WHEN WET, as the signs sometimes say, or slippery even in good weather if the surface is worn smooth.

What do kinesiology, anthropometry, and the coefficient of friction have to do with all this? Kinesiology is the study of the principles of mechanics and anatomy in relation to human movement. Anthropometry is the study of human body measurements, including the "geometry of the human stride." And the coefficient of friction is a number that provides a measure of the slip resistance of various materials and surfaces. For safety officials, manufacturers, and consumers concerned with the question of what slips least on what, answers must come from the relevant disciplines and concepts.

Exploring Slip Resistance

Friction measurement is attaining new sophistication as a result of recent work at the National Bureau of Standards by Dr. Robert J. Brungraber, Bucknell University civil engineering professor researching the subject under a special intergovernmental personnel program. The laboratory setting for Brungraber's work has been provided by the Institute for Applied Technology's Structures, Materials and Safety Division, part of the Center for Building Technology (CBT).

Brungraber's contributions are both theoretical and practical.

Exploring slip resistance literature in depth, he authored the recently published NBS Technical Note 895, *An Overview of Floor Slip Resistance Research With Annotated Bibliography.**

Testing Device

To improve the technology available for materials selection, field testing, and standardization of flooring and footwear, he has developed a new machine, the NBS-Brungraber Portable Slip Resistance Tester. In inventing the tester, Brungraber has built on the work of previous inventors and innovators, including NBS predecessors such as R. B. Hunter and Percy A. Sigler. The device is being patented and will be available for license to any U.S. citizen or corporation.

The Brungraber slip resistance tester is a timely contribution, of interest to flooring and shoe manufacturers, the floor wax and polish industry, bathroom fixture manufacturers, the swimming pool industry, insurance underwriters, the Consumer Product Safety Commission, the American Society for Testing and Materials—and the millions of Americans whose slips and falls are reflected in accident and injury statistics.

Common contributing agents of pedestrian downfall—in addition to banana peels—include water, dust, soap, physical infirmity, athletic activity and the like, but the Brungraber tester focuses on the floor surface and shoe material as the only items that can be reasonably controlled.

Performance Measuring

In developing his device, Brungraber relied on a complex set of principles fathered by Leonardo da Vinci, Guillaume Amontons and Charles Augustin de Coulomb, among others. From an accident prevention standpoint, Brungraber reasoned,

* Order by Catalog No. C13.46:895 at $2.30 a copy from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Add 25 percent for foreign mailing.

what these principles signify is that the frictional force resisting the start of sliding for two bodies at rest (foot and floor) affords the most practical measure of safety performance characteristics of flooring or footwear. Thus, the Brungraber tester operates by measuring the "static" coefficient of friction, as distinguished from measurement of the "dynamic" coefficient of friction.

The coefficient of friction is represented as the ratio of the force, F, required to slide one surface on the other, to the force, F', pressing the two surfaces together, or F/F'. When F is the force required to start the motion, F/F' is the static coefficient of friction; and when F is the force required to maintain a uniform motion, F/F' is the kinetic or dynamic coefficient of friction.

"For most materials," Brungraber notes, "the static value is higher than the dynamic value," the static value signifying the frictional resistance which must be overcome to initiate motion and the dynamic value signifying the threshold at which motion will continue. "Kinesiological studies made at Berkeley and in Sweden as well as analysis of motion pictures made at the National Bureau of Standards in the 1940's," he continues, "indicate that no slip occurs between the shoe and the floor during normal straight-line walking. . . ."

The new tester offers several advantages in addition to light weight, compact structure, and ease of operation:

• It moves over the floor, rather than having the flooring moved under the tester, so that it is suitable for evaluating floors under true field

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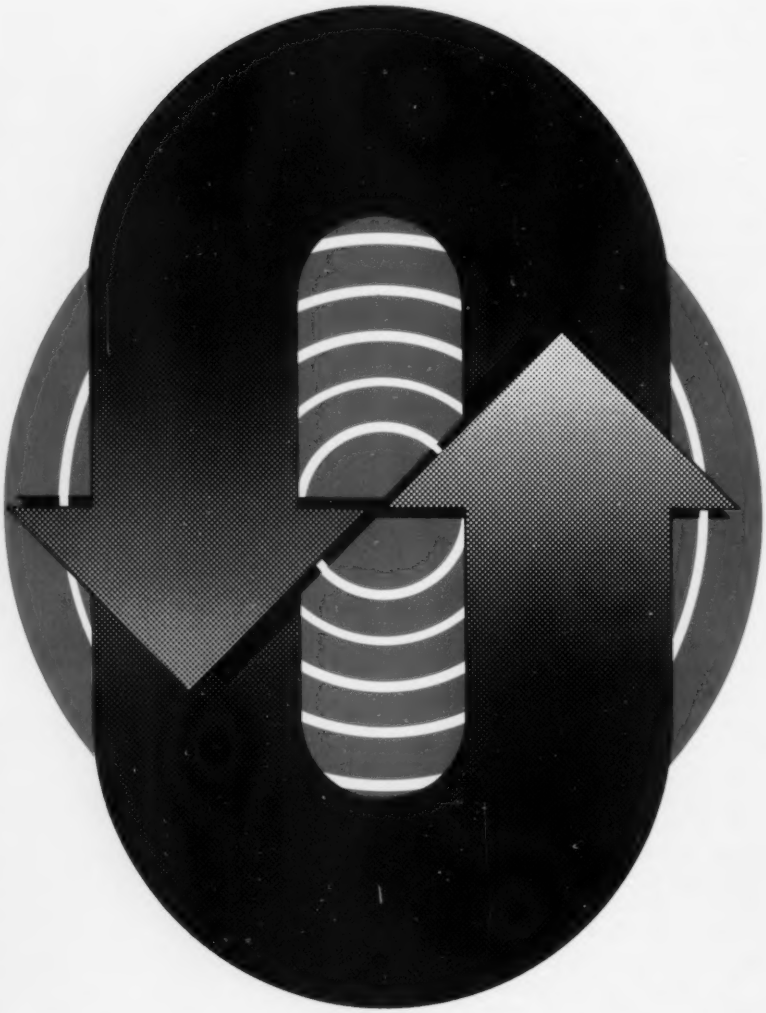
(Photos courtesy Consumer Product Safety Commission.)

Only a small sample of simulated skin material is required for "barefoot" slip resistance tests performed by the Brungraber machine. Here, Dr. Brungraber has turned the tester on its side while inserting the material.

With his portable tester set up in a soapsuds-filled bathtub, Dr. Brungraber can take readings on one of the most common and dangerous sources of calamitous slips and falls.

Why Waste Heat?

by Madeleine Jacobs
NBS public information specialist



AS early as 1961, a Florida restaurant learned it could use heat rejected during the building's normal air conditioning cycle to heat water for dishwashing and other uses. The company found that nearly half its hot water needs could be supplied in this way and in less than 3 years the cost of the equipment needed to recycle the waste heat was paid back in the form of reduced electrical bills. Today, this waste heat recovery application is under scrutiny by many organizations in Florida and elsewhere, including large food processing plants, supermarkets, and office buildings.

As this example illustrates, the idea that heat lost to the environment during industrial and commercial processes can somehow be captured and put to useful work is not new. "Despite this fact, many engineers today are not aware of all the options in waste heat recovery," says Dr. Kenneth Kreider, who is manager of the National Bureau of Standards' industrial program in the Office of Energy Conservation. "The reasons are understandable. Until recently, fuels were cheap and readily available. This made payoff times for waste heat recovery equipment fairly long, and for that reason recovering waste heat was not an important investment to most companies. Now, of course, energy is expensive and few companies can afford to overlook any options."

Kreider points out that the industrial and commercial sectors of the United States use more than a third of the nation's energy budget. In

NBS, FEA Handbook Will Help Industry Conserve Energy Through Waste Heat Recovery Management

fact, nine industries alone use half this energy—plastics, cement, aluminum, steel, glass, paper, rubber, food processing, and agriculture. A typical plant that installs waste heat recovery equipment could save about 20 percent of its fuel, Kreider estimates.

Waste Heat Help

As a result of the continuing energy problem, NBS and the Federal Energy Administration (FEA) decided to put together information to help engineers and managers learn more about the potential for recovering waste heat. The result of this effort is the *Waste Heat Management Guidebook,* to be published later this year by NBS.

"The purpose of the guidebook," Kreider explains, "is to inform the engineer or manager about the available options in waste heat recovery. This information will help him decide whether he can increase profits by installing waste heat equipment and also help choose the best available equipment for this purpose."

The eight chapters of the book were developed with this aim in mind by waste heat engineering experts in industry, universities, and at NBS. "The heart of the guidebook is 14 actual case studies of companies that have recently installed waste heat recovery systems and profited," Kreider notes. "We hope not only that the reader finds interesting applications, but also that he discovers various approaches to solving a number of waste heat recovery problems."

The case studies were selected to represent major commercial options in waste heat recovery equipment, such as radiation recuperators, economizers, and heat wheels. Various industrial applications of heat recovery are included in such areas as glass making, forge furnace operation, and paint and varnish processing. The case histories also represent companies in various geographical locations in the United States.

Demonstrating Value

In addition to case studies, the book contains seven additional chapters. The first three outline and describe the necessary steps an engineer should take to demonstrate the value of waste heat recovery to himself and to his management. The first chapter deals with sources and uses of waste heat and provides an orientation for the reader to relate the guidebook to his plan or interest. It also contains a discussion on organizing and implementing waste heat management programs. Chapter two provides information that will help the engineer make the engineering assessment of his

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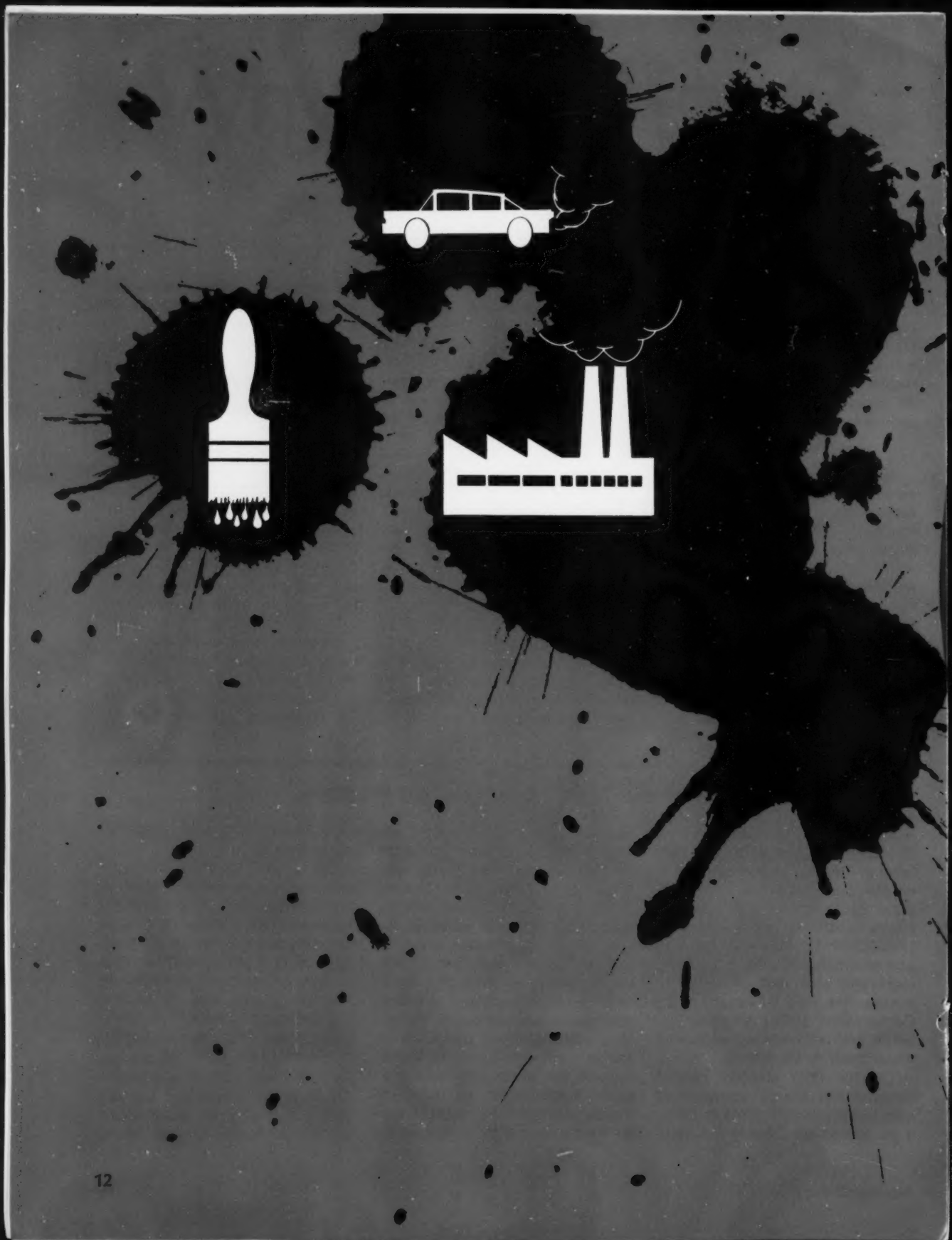
Industrial Energy Management Program

The *Waste Heat Management Guidebook* is part of the Department of Commerce program, based on the *Energy Conservation Program Guide for Industry and Commerce* (EPIC) handbook (January DIMENSIONS), to assist industry and commerce in adjusting to the increased cost and shortage of energy. The NBS Office of Energy Conservation (OEC) supplies scientific and technical support to the department in its efforts.

Specific OEC projects related to industrial energy conservation also include supplements to EPIC, a guidebook specifically for small businesses engaged in light industry and commerce, a guide for educational courses in energy conservation practices, case studies in small businesses, and process energy conservation manuals for such areas as steam systems, furnaces, kilns, and ovens. OEC also provides, as requested, technical review and analysis of industrial processes, research proposals, and legislative proposals in energy conservation; technical support for workshops; and program management for effective coordination of NBS projects and for interactions with other government, academic, and industrial institutions.

Other OEC projects currently sponsored by the Energy Research and Development Administration include establishing a data base for combustion modeling, conducting studies of performance criteria for blended cements designed to conserve energy, and developing test methods to characterize waste paper pulps with an eye toward increased paper recycling.



Research Casts New Light on an Old National Health Problem: **Lead Poisoning**

by Frederick P. McGehan
NBS public information specialist

LEAD poisoning among small children—particularly in inner-city areas—has been a recognized health problem in this country for a number of years. And it has been axiomatic to trace the problem to lead-based paint used in homes, especially those homes constructed before World War II when lead-based paint had its greatest use.

The National Bureau of Standards, through its Center for Building Technology, has assisted the Department of Housing and Urban Development (HUD) in assessing the magnitude of the problem. Early work by NBS produced an initial estimate that 500,000 American children might have elevated levels of lead in their blood. Of these children, it was predicted that 12,000 to 16,000 would have enough lead in their bodies to constitute lead poisoning as defined by U.S. Department of Health, Education and Welfare guidelines.

NBS' latest research report to HUD* is shedding new light on the assumed causal relationship between blood lead levels and lead-based paint. Data presented in that report indicate the lack of a positive correlation between paint in housing and blood lead levels in children. The implication is that other environmental and social factors may act to cause or mitigate elevated blood lead levels. If confirmed conclusively, the NBS work will have made a significant contribution to research programs aimed at controlling the lead poisoning menace.

Urban Area Surveyed

NBS' findings are the result of the most comprehensive and statistically valid survey of lead paint in housing ever undertaken in a major metropolitan area. Some 4,000 dwelling units in Pittsburgh, Pa., were examined over a year's time by the Allegheny County Health Department under a $103,000 contract with NBS. A total of 456 children 7 years of age and under living in these units were tested for blood-lead levels.

To gather the data, the Allegheny County Health Department sent out eight two-person teams to inspect the dwellings with portable X-ray fluorescence instruments to measure lead levels in paint on walls and other exposed surfaces. Later, after parental permission was granted, a health worker took blood samples from children.

NBS monitored the survey closely, particularly to control sampling techniques and contamination in the blood collection. Children found to have elevated blood lead levels on initial screening were retested and, in most cases, blood levels in the normal range were found. Large numbers of "false positives" have been a problem in many lead poisoning screening programs.

Checking Accuracy

As a further check on the accuracy of blood analysis, two samples of blood were collected from 10 percent of the children tested. These samples were analyzed by both the Pittsburgh commercial laboratory that had the contract for analyzing samples and by chemists at the National Bureau of Standards. Another check was performed by sending samples of pig blood with known amounts of lead for analysis by chemists at the Pittsburgh and NBS laboratories. The pig blood samples were made up to resemble children's blood samples. The results of these crosschecks were well within acceptable limits for error.

A total of 15 children—out of the 456 tested—showed indications of elevated blood lead levels (greater

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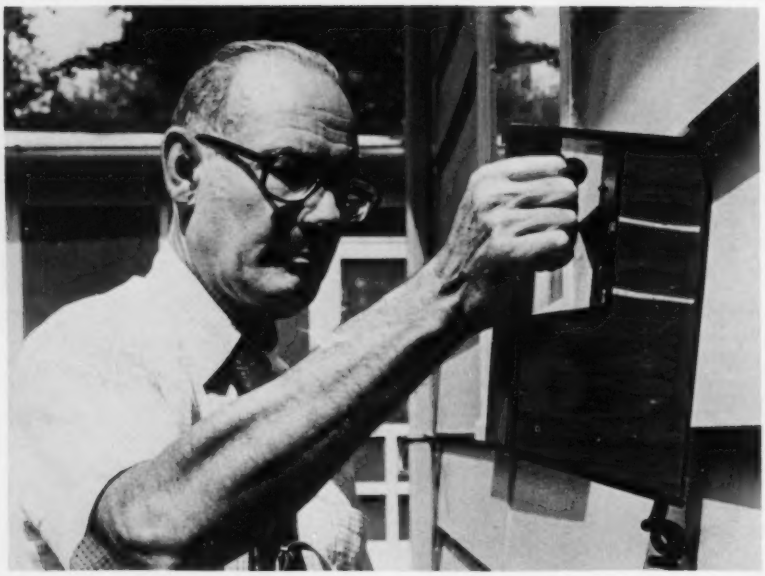
* NBSIR-76-1024, "Statistical Analysis of Blood Lead Levels of Children Surveyed in Pittsburgh, Pennsylvania: Analytical Methodology and Summary Results" by Walter D. Urban.



Philip Cramp, a chemist with NBS' Center for Building Technology, operates a portable X-ray fluorescence instrument to measure the lead level on the exterior wall of a house.

A workman uses a scraper to remove lead-based paint from a kitchen wall.

than 40 micrograms of lead per 100 milliliters of whole blood) on the first screening. Upon retest only two children were found to have high blood lead levels. One of these children (with a blood level of 75 micrograms) had been retarded since an early age and was treated for lead poisoning. The other child was placed under medical surveillance.

Of the 456 children tested, a total of 391—or 85.7 percent—lived in dwellings where at least one exposed surface contained 2 milligrams of lead per square centimeter. These were considered contaminated surfaces.

Surprising Conclusions

The survey report, written by Walter D. Urban of NBS' lead-based paint poisoning program, concluded:

"In this survey the incidence of elevated blood lead levels among the tested children was less than 1 percent. Since more than 80 percent of the children lived in the dwellings containing some degree of lead paint, it appears that in Pittsburgh, at least, the presence of lead paint in housing per se does not cause elevated blood lead levels.

"No explanation may be advanced at this time as to why this is so. Nevertheless, the reason for this apparent anomaly is of great interest and potential value."

The only relatively strong correlation between the dwelling units and children's blood lead levels had to do with the age of the dwellings. Children living in the oldest dwellings —independent of the lead content of exposed surfaces—had the highest blood lead levels. The reason is not clear.

However, Harvey W. Berger, manager of the lead-based paint poisoning program at NBS, believes the latter finding indicates that neighborhood characteristics may play a significant role in lead poisoning. Higher blood-lead levels, for example, may be found in older neighborhoods which may be adjacent to heavy industry or in which there is a heavy volume of vehicular traffic.

Berger notes that the lead poisoning problem—once considered solely the result of deteriorating housing—is beginning to be viewed in a broader context. "Lead poisoning is the problem, not just lead-based paint poisoning," he says. Many other factors including lead in the air, in dust and dirt, in water pipes, and particular circumstances, such as the location of dwellings near lead smelters and battery processing plants, contribute to the problem.

"The Pittsburgh survey data and results will form a firm and sound technical base for further research into the total environmental impact of lead on the national lead poisoning problem," Berger adds.

Follow-Up

As a follow-up to the Pittsburgh survey, NBS has issued a $55,000 grant to the University of Pittsburgh School of Public Health to study the survey results and to develop some hypotheses as to why so little lead poisoning was found in Pittsburgh.

Berger says the Pittsburgh survey also raises a caution flag for public officials seeking ways to eliminate the lead hazard. Massive programs to rehabilitate dilapidated or deteriorating housing in order to remove lead paint from walls may not be the answer. "If there are other sources of lead contamination that are more significant and affect more children, and we don't recognize that and react to it properly, then we will have committed massive resources without solving the problem," Berger notes.

If, for instance, it is found that inhaling paint dust—rather than eating chips or flakes—is more important as a causitive agent, then the solution might be to eliminate the dust by painting over the surfaces with non-leaded paint. "It's a lot cheaper than taking paint off the walls with a burner and a scraper," Berger says.

The Department of Housing and Urban Development plans to conduct additional surveys and research to build upon the Pittsburgh experience and findings. NBS will assist in the design of those activities and in the analysis of survey data.

"We aren't denying that some children are getting lead poisoning by eating chips of lead paint," Berger notes, "but it is not the hundreds of thousands of children we thought it was years ago. It is considerably less."

"The Pittsburgh study," he adds, "is by no means conclusive (in disproving the lead-based paint assumption). But it is a cornerstone and we have to build on it." □

Manual on Lead-Paint Surveys

A manual has been developed primarily for use by local government officials in planning, executing, and evaluating housing surveys for lead-paint problems. This publication is an outgrowth of the Pittsburgh survey and two previous studies of housing units for traces of lead-paint contamination.

The manual, which contains four major sections, describes in detail the resources required for such an undertaking, preparations for the field work (such as selection of sample size, staff training), data collection and analysis, and supporting technical information.

Copies of the manual, prepared for the Office of Policy Development and Research, Department of Housing and Urban Development, are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Ask for NBS Technical Note 921, "Survey Manual for Estimating the Incidence of Lead Paint in Housing." SD Catalogue No. C13.46:921. $2.20.

CORRECTION

Table 2 on page 20 in the July issue of DIMENSIONS/NBS should have listed the number of oil from shale plants needed by the year 2000 as 80 and the number of coal liquefaction or gasification plants as 140.

HIGHLIGHTS

How Firefighters Die

Of 101 firefighter deaths investigated recently, 45 percent were caused by heart-related problems. This finding comes from an NBS-funded study by the International Association of Firefighters and is included in *Firefighter Mortality Report*. The report, which consists of case studies of individuals who died in the line-of-duty, should be useful to fire fighting instructors and of interest to firefighters. Copies of the report can be obtained from the National Fire Prevention and Control Administration.

U.S. Industry to Benefit from Polymer Study

NBS researchers have for the first time in this country successfully applied neutron scattering techniques to the study of block copolymers. Block copolymers are a class of commercially important elastomers and plastics which can, for example, replace vulcanized rubber, serve as a substitute for metals in the transportation industry, be used for recyclable beverage containers. Up to this time, industry has had difficulty in finding effective quality control techniques for these materials. Quality control measurements will be made easier as the molecular structure of block copolymers is identified at NBS using small angle neutron scattering from partially deuterated samples.

Field Ion Microscopy Improved

Atomic structure and atomic movements on metal surfaces can now be viewed in three colors. This photographic improvement in field ion microscopy was made recently by NBS scientists. Using three-color component phosphor and appropriate filters, researchers superimposed color images on a single frame of color film. As a result, seven colors conveyed information in the composite image. This method is particularly useful in observing small changes in the images, such as those that occur during sequential field evaporation of atoms or whole crystal planes. The technique can also show atomic details of adsorption and desorption.

Radiation Safety Film Released

A film on radiation safety for users of analytical x-ray equipment has recently been released. Titled *The Double-Edge Sword,* it involves interviews with victims for first-hand accounts of accidents and photographs from medical records to show the injuries that result. The film is especially recommended for new users of diffraction or spectrographic equipment, including installation and maintenance personnel. *The Double-Edge Sword* was produced by NBS for the Bureau of Radiological Health of the Food and Drug Administration. It is available on free loan through Association-Sterling Films, 1815 North Fort Myer Drive, Arlington, Va., 22209 and is for sale through the Sales Branch, National Audiovisual Center (GSA) Washington, D.C. 20409. The price is $105.50. Running time for the 16mm color film is 23 minutes. A video cassette version is also available on a free loan basis from the Training Resources Center (HFX-70) DTMA, BRH, FDA, 5600 Fishers Lane, Rockville, Md. 20852.

NBS Releases New Free Loan Film

A new 28½ minute motion picture, "Standards for Excellence," released by NBS, illustrates the impact of standards and measurement on everyday life—and the excitement of scientific discovery. The color film, featuring actor John Astin, is suitable for general audiences from school children to scientists. It is available on free loan from Association Films, Inc., 866 3rd Avenue, New York, New York 10022, or may be purchased from the National Audiovisual Center, Order Section (NAC) General Services Administration, Washington, D.C. 20409 for $131.75.

John Astin

Boulder Labs to Hold Open House

Commerce Department staff in Boulder, Colo., will devote October 14-16 to visitors who want an inside look at a federal science laboratory. Next month's open house is part of the NBS 75th anniversary celebration. Tours, exhibits, and presentations will acquaint visitors with Bureau programs in time and frequency, low-temperature research, and electromagnetics. □

Sampler Measures Optical and Electrical Pulses

HIGH-speed electronics in the computer, communication, and laser fields currently require measurements for electrical and optical pulses as minute as a few trillionths of a second.

To help meet the need for improved measurements, two researchers at the National Bureau of Standards Boulder, Colo., have developed a sampling oscilloscope which measures both types of pulses with a single sampling head.

The device has a potential resolution of 10 picoseconds (1 ps = 10^{-12} seconds), a broader bandwidth and greater dynamic range than conventional instruments, and is also free of sampling pulse interference.

Optical pulses are most often measured with a sampling oscilloscope whose sampling head employs a photodiode as optical-to-electrical transducer. The resulting electrical pulse is then sampled. However, these oscilloscopes distort the pulse because of limited bandwidth in the detector circuits.

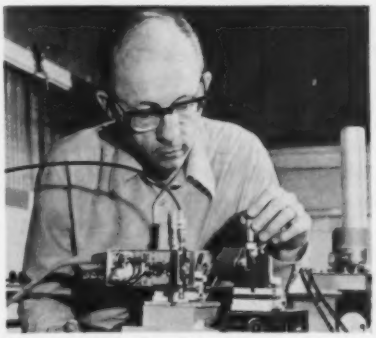
Drs. Robert A. Lawton and James R. Andrews of the NBS Electromagnetics Division have designed and built an improved sampling head which isolates sampling interference. Isolation is accomplished by optically sampling electrical pulses and, conversely, electrically sampling optical pulses. The new sampling head uses a gallium arsenide (GaAs) photoconductor, instead of a photodiode, as transducer.

The photoconductor output is the product of the optical and electrical waveforms, regardless of which is the sampling and which the sampled pulse. This product-forming property, essential to the sampling operation, cannot be obtained with a photodiode in its normal reverse-biased mode.

The NBS sampling circuit employs the photoconductor shunt capacitance and stray wiring capacitance as a sampling capacitor. Thus, unwanted and unavoidable effects are exploited to gain greater bandwidth in sampling optical waveforms.

By combining the detecting and sampling functions in one GaAs chip and centralizing these and other signal processing operations in the sampling head, Lawton and Andrews expect to attain greater fidelity in the scope's displayed pulse waveform.

With its GaAs photoconductor, the NBS instrument samples both optical and electrical pulses. Lawton and Andrews used a GaAs diode laser to provide an optical pulse for sampling electrical waveforms in the first prototype instrument. These light pulses are as short as 110 ps at a wavelength of 0.9 micrometers. When an electrical pulse is to be measured, it is impressed across the GaAs chip which is then illuminated by a light pulse from the laser.



(Photo by Harry Covey.)

This laser pulse allows the photoconductive chip to conduct current proportional to the electrical pulse voltage at that instant. The electrical pulse is thus optically sampled. The present sample withstands 12-volt impulses, but a model with wider contact gaps on the GaAs substrate has been subjected to 450 volts without damage.

For an optical pulse waveform to be electrically sampled, the optical pulse is focused onto the GaAs chip whose conductivity follows the variation of the optical waveform. When an electrical sampling pulse is applied across the chip, the conductivity during sampling determines the current through the chip. Thus for sampling with either optical or electrical pulses, the sampling current is proportional to the waveform being sampled. □

Crime Labs Aided by Standard Reference Materials

TWO new Standard Reference Materials (SRM's) that will aid forensic scientists and law enforcement officials in more accurate analyses of evidence have been issued by the National Bureau of Standards Office of Standard Reference Materials.

SRM 1821, Ethanol (ethyl alcohol) will help insure accurate calibration of instruments used to determine alcohol content of blood or breath,

turn page

and SRM 1823, Refractive Index Silicone Liquids, will help identify glass fragments.

The alcohol SRM will be used to calibrate and verify the accuracy of various methods used by law enforcement officials to determine blood or breath alcohol concentration of drivers suspected of driving under the influence of alcohol.

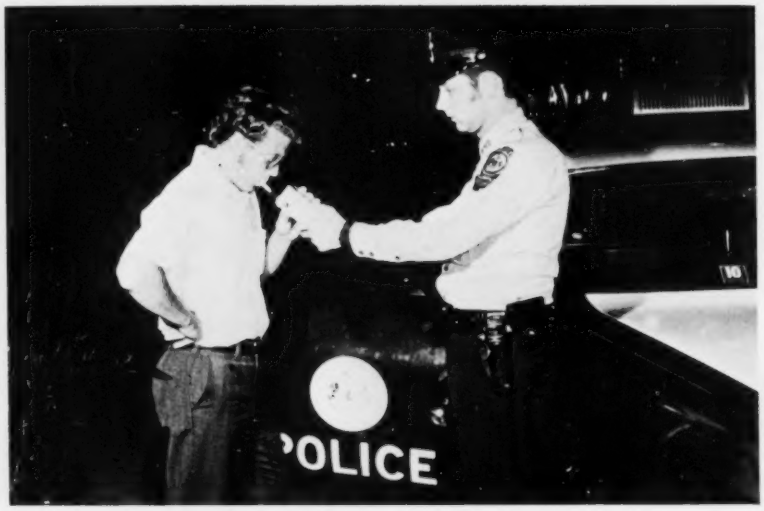
All states now have "implied consent" laws requiring that drivers, in order to obtain and keep their licenses, be willing to submit to chemical tests when requested to do so by police. By assuring the accuracy of these tests, the new SRM will help guarantee that the evidence obtained stands up in court.

SRM 1821 is more than 99.9 percent ethanol, analyzed for water and certain organic compounds. It is furnished in units of 12 sealed ampoules, each containing 10 milliliters of ethanol. The price is $57 a unit.

SRM 1823, Refractive Index Silicone Liquids, has been prepared to meet the need of crime laboratories where forensic scientists use refractometers and microscopes to identify glass fragments, such as automobile headlight glass, submitted as evidence.

The SRM will also be useful to industrial laboratories where these instruments are used to determine product purity and quality and process control. About 5,000 refractometers are in use today in the food, sugar, glass, paint, plastic, pharmaceutical, petroleum, chemical, and optical industries and in university and research laboratories.

Technical support for certification of SRM 1823 came from the National Institute of Law Enforcement and Criminal Justice, Law Enforcement Assistance Administration, U.S. Department of Justice. It was coordinated through the NBS Law Enforcement Standards Laboratory in conjunction with the Office of Standard Reference Materials.



SRM 1823 consists of two silicone liquids that are thermally and chemically stable over a wide temperature range. The liquids span the refractive index range of a variety of glasses and fibers that are examined by means of immersion techniques in forensic science laboratories. They are certified for refractive indexes at 10 wavelengths that span the visible spectrum and at four temperatures, from 20°C to 80°C.

SRM 1823 is issued as a unit consisting of two glass vials, with screw caps, each of which contain 60 milliliters of liquid. The price is $55 a unit.

All orders and requests for information concerning the SRM's should be directed to the Office of Standard Reference Materials, Room B311, Chemistry Building, National Bureau of Standards, Washington, D.C. 20234, 301/921-2045. □

NBS-FDA To Develop Systems for Monitoring Newly Approved Drugs

THE Food and Drug Administration (FDA) and the Commerce Department's National Bureau of Standards have announced a million dollar joint project to develop systems for monitoring newly approved medicines for unwanted reactions. The systems would help FDA uncover previously unsuspected adverse effects more quickly than is now possible.

Alexander M. Schmidt, M.D., Commissioner of FDA, said: "Before FDA approves a new drug, it has been tested extensively in animals but at most in only a few thousand people.

Once it is approved, the number of people who receive the drug often increases rapidly to many thousands. But, some adverse effects are so rare they can be detected only after a drug has been used by many thousands of patients or for an extended time.

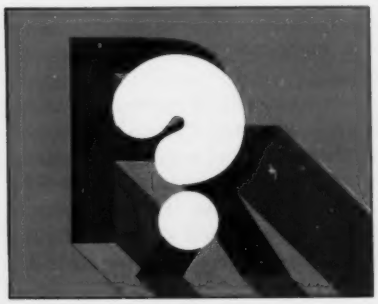
"For this reason, the first few years after a drug is approved is a time for special alertness and careful evaluation.

"This project will help FDA develop standards to make better and faster decisions on long term drug safety and effectiveness," said the Commissioner.

"In addition," said Schmidt, "legislation now before the Congress would give FDA authority to require manufacturers to conduct post-marketing studies of new drugs. Clearly we could make better use of such authority if we had effective drug monitoring systems. With NBS assistance we will develop such systems."

NBS' Experimental Technology Incentives Program (ETIP) will provide $1.1 million and assistance in experimental design and evaluation. FDA will develop and test the systems under one or more contracts to be awarded on a competitive basis.

"We are pleased to be able to assist the Food and Drug Administration in this project," said Dr. Jordan Lewis, director of ETIP. "We are hopeful that it will lead to an improved regulatory policy that will benefit all citizens." □



Call for Papers Issued for Thermophysical Properties Symposium

PAPERS are now being solicited for the Seventh Symposium on Thermophysical Properties to be held May 10 to 12, 1977, at the National Bureau of Standards in Gaithersburg, Md.

The symposium will be co-sponsored by NBS and the American Society of Mechanical Engineers.

Objective of the symposium is to provide a forum for presenting and discussing research activities in the thermophysical properties field. Special emphasis will be placed on experimental and analytical work on thermophysical properties relevant to energy problems, including properties of materials used or likely to be used in nuclear reactors, magnetohydrodynamic generators, and in other applications such as solar and geothermal energy.

Other areas in which papers will be considered are:

- Theoretical studies of thermodynamic and transport properties.
- Measurements of thermodynamic properties including heat capacity, enthalpy, energy of phase transition, thermal expansion, and others related to PVT, calorimetric, and thermochemical studies.
- Measurements of transport properties including thermal and electrical conductivity, thermal diffusivity, viscosity, and related properties.
- Theoretical and experimental studies related to thermal radiative properties including emittance, absorptance, and reflectance.
- Reviews of current status of theory on thermophysical properties.
- Critical evaluation of experimental techniques.
- New developments in experimental techniques and instrumentation relevant to thermophysical measurements.
- Reference materials for thermophysical properties and related calibration procedures.
- Methods of collection, evaluation, correlation, and dissemination of thermophysical properties data.

Prospective authors should submit abstracts of 200-300 words to the symposium chairman by November 1, 1976. Content of the abstract will be the basis for acceptance of a paper for presentation at the symposium. Authors whose papers are accepted will be required to submit three review copies of the full paper to the symposium chairman by April 1, 1977. To submit an abstract, write to Dr. Ared Cezairliyan, Symposium Chairman, Seventh Symposium on Thermophysical Properties, Room 124 Hazards Building, National Bureau of Standards, Washington, D.C. 20234, 301/921-3687. □

Computer Documentation Guidelines Issued

GUIDELINES for the documentation of computer programs and automated data systems are now available in a National Bureau of Standards Federal Information Processing Standards (FIPS) publication, FIPS PUB 38.

The new publication was produced in an effort to improve the quality of documentation in Federal computer applications. Its use is expected to result in improved software support and will facilitate the sharing of computer programs and information among Federal users.

FIPS PUB 38 will serve as a basic reference and checklist for general use of automatic data processing managers in determining the content and extent of documentation necessary for computer programs and automated data systems.

The guidelines were developed by an interagency task group on Documentation for Information Processing Systems (FIPS Task Group 14). FIPS PUB 38 identifies the major software development phases and provides guidelines for 10 different document types, including documentation needed for:

Functional Requirements
Data Requirements
System/Subsystem Specification
Program Specification
Data Base Specification
Users Manual
Operations Manual
Program Maintenance Manual
Test Plan
Test Analysis Report

FIPS PUB 38, entitled *Guidelines for Documentation of Computer Programs and Automated Data Systems*, is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (SD Catalog No. C13.52:38) at $1.35 per copy. Microfiche copies are available at $2.25 each from the National Technical Information Service, 5825 Port Royal Road, Springfield, VA 22151 (refer to NBS FIPS–PUB 38 and title). □

NBS to Publish LNG Data

PERTINENT data on liquefied natural gas (LNG) traceable to a reputable reference source will soon be made available by the National Bureau of Standards.

An NBS loose-leaf publication, "Liquefied Natural Gas Materials and Fluids Data" will be published in the fall. It is the first book of its kind for up-to-date LNG data. The book includes data generated by the Cryogenics Division or data assessed and evaluated at NBS, in a format consistent with requirements of users, such as field engineers, plant managers, and process engineers.

Graphic presentation of data is featured. Tables and analytical expressions will only be used if appropriate. This format allows users a ready reference of assessed quality for data applied to conceptual design, process monitoring, and process analysis.

The initial edition and expandable binder will contain LNG materials data on structural metals and alloys, pure fluids data on methane and nitrogen, and fluid mixtures data involving methane, nitrogen, and ethane. Supplements now being planned will include: data on thermal insulation, joining materials, structural composite materials and aggregates, polymeric materials, and miscellaneous non-structural materials; pure fluids data on ethane, propane, and iso and normal butane; and fluid mixtures data of methane with propane, and iso and normal butane.

Although the data book is only one of many ways to provide properties data of known quality in a consistent format to LNG industry workers, this approach provides the most current data and references available for user assessment. The book's intent is to complement traditional scientific literature publications which emphasize measurement science, technique, precision and accuracy.

Information of "Liquefied Natural Gas Materials and Fluids Data" may be obtained by contacting Douglas Mann, National Bureau of Standards, Cryogenics Division, 325 Broadway, Boulder, Colo. 80302 or telephoning (303) 499–1000, ext. 3652. □

Cryogenic Activities Described

ACTIVITIES of the National Bureau of Standards Cryogenics Division are described in two volumes of *Advances in Cryogenic Engineering*, a CEC (Cryogenic Engineering Conference) publication. The series offers an interdisciplinary review of low temperature technology and updates knowledge of cryogenic processes, equipment, instrumentation, properties, and applications.

To be released by Plenum Publishing Corporation this fall, volume 21 contains the CEC papers. Volume 22 contains the ICMC (International Cryogenics Materials Conference) papers given at the joint CEC and ICMC 1975 Conference.

NBS contributions to volume 21 include articles in four major headings:

- Energy Systems—"Economic Aspects of U.S. Energy Independence in the Coming Decade."
- Refrigeration — "Low-Temperature Losses in Supercritical Helium Refrigerators."
- Safety—"Dispersion of Hydrogen or Methane Fuels Released in an Automobile Interior."
- Fluid Properties—"On the Consistency of Liquid-Vapor Equilibria Data for Binary Mixtures of Methane with the Light Paraffin Hydrocarbons," "Orthobaric Liquid Densities of Normal Butane from 135 to 300 K as Determined with a Magnetic Suspension Densimeter," and "Thermophysical Properties Data Research on Compressed and Liquefied Gases at the NBS Cryogenics Division."

Ten NBS articles appear in volume 22 under four major headings, including:

- Structural Alloys/Fracture — "A Research Program on the Properties of Structural Materials at 4 K," "Fracture Mechanics and its Application to Cryogenic Structures," "Fatigue Crack Growth Rates of Structural Alloys at 4 K," and "The Fracture Toughness and Fatigue Crack Growth Rate of an Fe-Ni-Cr Superalloy at 298, 76, and 4 K."
- Structural Alloys/Physical Properties — "Magnetogeothermal Conductivity of Selected Pure Metals and Alloys," "Thermal and Electrical Measurements on Selected Materials for Low-Temperature Applications," and "Low-Temperature Elastic Properties of Invar."
- Composites — "Static Tensile Properties of Boron-Aluminum and Boron-Epoxy Composites at Cryogenic Temperatures."
- Stress Effects in Conductor Materials—"Effect of Stress on the Critical Current of NbTi Multifilamentary Composite Wire," and "Low-Temperature Tensile Behavior of Copper — Stabilized Niobium-Titanium Superconducting Wire."

The Cryogenics Division located in Boulder, Colo., is the only federal laboratory providing complete measurements and data services to support the nation's very-low-temperature science and technology. The division makes available reliable cryogenic measurement methods; measures the properties of cryogenic liquids and solids; gathers, evaluates, and compiles worldwide literature on research and development at cryotemperatures; performs scientific and engineering research; provides consulting services to federal agencies and public institutions; and aids in developing codes, standards, and practices for the safe handling of liquefied gases. □

Accuracy in Environmental Standards is Theme of Symposium

MORE than 100 papers on the latest developments in environmental measurements standards will be delivered at the 8th Materials Research Symposium: Methods and Standards for Environmental Measurement, on September 20–24, 1976, at the National Bureau of Standards in Gaithersburg, Md.

The symposium will provide an opportunity to evaluate needs for improved measurement methods and standards associated with the achievement of national environmental goals. Accuracy of existing and new methods of measuring air and water pollution and the means for achieving accurate measurements will be emphasized.

The symposium will consist of a series of invited lectures by environmental experts from the United States and abroad, as well as the presentation of contributed papers.

The eleven sessions and names of invited lecturers are:

- Application of Laser Technology to Atmospheric Monitoring, Aram Mooradian, MIT Lincoln Laboratories, Lexington, Mass.
- Determination of Trace Organic Pollutants in Water, William Donaldson, Environmental Protection Agency, Athens, Ga.
- Multielement Analysis, Philip La Fleur, National Bureau of Standards, Gaithersburg, Md.
- Accuracy, William Fitzgibbons, Standard Oil, Cleveland, Ohio.
- Air Pollution Measurement, George Morgan, Environmental Protection Agency, Las Vegas, Nev.
- Water Analysis, James Ross, Jr., Orion Company, Cambridge, Mass.
- Chemical Characterization of In-

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ENVIRONMENTAL *continued*

organic and Organometallic Constituents, Robert Braman, University of South Florida, Tampa, Fla.

- Physical Characterization of Aerosols, Kenneth Whitby, University of Minnesota, Minneapolis, Minn.
- Chemical Characterization of Aerosols: Progress and Problems, William Wilson, Environmental Protection Agency, Research Triangle Park, N.C.
- Collaborative Testing, John Clements, Environmental Protection Agency, Research Triangle Park, N.C.
- The Status of Reference Materials for Environmental Measurement, John Taylor, National Bureau of Standards, Gaithersburg, Md.

The symposium is sponsored by the NBS Institute for Materials Research and is the eighth in the series which began in 1966. This symposium, which is also being held in celebration of the 75th anniversary of NBS, is expected to attract about 250 scientists from the United States and abroad.

A registration fee of $75 is being charged to attendees. For information on attending the conference, write to Ronald B. Johnson, Materials Building, B348, National Bureau of Standards, Washington, D.C. 20234. □

conditions.

- It uses a graduated rod to permit direct reading of the static coefficient of friction.
- Self-actuated, it needs no power source and allows for a quicker test procedure (approximating the passage of time during a normal step). This avoids a distorted test situation of the past, involving the squeezing out of intervening water layers and a consequent frequent but illogical finding that leather soles are more slip resistant on wet surfaces than on dry ones.

Timing can be crucial.

Suppose, for example, that the effect of some agent such as water is to be studied. The test must carefully reproduce the action of a human foot during normal walking.

"Specifically," observes Brungraber, "the lateral or sliding load must be applied as soon as vertical or normal force is applied so that the agent will not be squeezed out prematurely." During normal walking on wet surfaces there is likely to be a significant layer of water between the sole or heel and the floor so that fluid friction would be present, resulting in rather low values of coefficient of friction. If, however, the normal force is permitted to stand before the application of the lateral force, the water layer will be squeezed out, leaving only a thin molecular layer of water—which has been shown to enhance adhesion and thus increase the friction unrealistically.

Second Model

Brungraber designed his slip-resistance tester to meet such problems and provide for realistic performance tests. In NBS laboratories under controlled humidity conditions, the tester itself has undergone performance evaluation, and the first working model has been followed by a second of simpler, less expensive design.

Though friction is a familiar, centuries-old subject, Brungraber still sees it as among the "least understood" of mechanical phenomena. Nevertheless, his new machine will help to cope with everyday problems encountered by people. It can be used for evaluations to determine whether a surface or shoe material is too slippery or too "grabby"—in the latter case, possibly contributing through excessive friction to stubbed toes and ankle or knee injuries, particularly in sports. It can also help in answering numerous questions, including:

Can we come up with improved surface materials to prevent bathtub slips and falls—among the most common and dangerous home accidents? What can be done about other wet-surface situations—at poolside, on boat decks, and the like? How do we predict the slip-resistance of new and experimental linoleums, woods, tiles, turfs, leathers, synthetics, floor polishes, shoe softeners?

Further technical refinements in testing and appraisal of slip resistance are bound to come. And Brungraber expects to continue his interest in this complex field. Characteristically, he will be rolling up both his sleeves and his cuffs as he explores, barefooted, the ultimate slipperiness hazard—the unadorned human foot operating on a wet surface. □

waste heat recovery problem. The third deals with concepts and analytical techniques that can guide the industrial plant manager in evaluating the economic efficiency of investments in waste heat management. It explains in textbook fashion and demonstrates in simplified but realistic examples the use of alternative methods of evaluating and comparing energy saving investments. Several techniques are described and their advantages and disadvantages explained so that the reader may select an approach which fits his situation.

The remainder of the book deals with detailed discussions of the types of equipment that can be used in waste heat systems and with instrumentation for measuring quantities of importance in waste heat management. Engineering data are also included.

"An important point about waste heat recovery equipment is that it generally involves using off-the-shelf technology," explains Dr. Michael McNeil, who co-edited the guidebook with Kreider. "This means the equipment is already available and systems can be put into operation immediately. It is my view that development of new waste heat technology is less important at present than efficient use of the technology that already exists."

Both Kreider and McNeil emphasize that the book is not a "do-it-yourself" manual, but rather a guide that can help in deciding whether it is advisable to install waste heat recovery equipment. Says McNeil, "There's a lot of know-how in the waste heat recovery field that has been developed in specific industries where fuel has been an important part of operating costs—like the electrical utility industry. This know-how has not been entirely transferred to other areas, and most engineers are not familiar with what is being done. We hope the new guidebook will help complete the transfer." □

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of the National Bureau of Standards

Building Technology

Marshall, R. D., *Engineering Aspects of Cyclone Tracy, Darwin, Australia, 1974*, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 86, 39 pages (June 1976) SD Catalog No. C13.29/2:86, $1.05.

Computer Science and Technology

Goldstein, R. C., Seward, H. H., and Nolan, R. L., *A Methodology for Evaluating Alternative Technical and Information Management Approaches to Privacy Requirements*, Nat. Bur. Stand. (U.S.), Tech. Note 906, 72 pages (June 1976) SD Catalog No. C13.46:906, $1.35.

Health and Safety

Schafft, H. A., Ed., *Semiconductor Measurement Technology: NBS/FDA Workshop. Reliability Technology for Cardiac Pacemakers*. Nat. Bur. Stand. (U.S.), Spec. Publ. 400-28, 49 pages (June 1976) SD Catalog No. C13.10:400-28, $1.25.

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Buehler, M. G., *Semiconductor Measurement Technology: Microelectronic Test Pattern NBS-3 for Evaluating the Resistivity-Dopant Density Relationship of Silicon*, Nat. Bur. Stand. (U.S.), Spec. Publ. 400-22, 57 pages (June 1976) SD Catalog No. C13.10:400-22, $1.45.

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Wells, J. S., Streit, G. E, and Petersen, F. R., *Application of Infrared Frequency Synthesis Techniques with Metal-Insulator-Metal Diodes to the Spin Flip Raman Laser*, Nat. Bur. Stand. (U.S.), Tech. Note 680, 14 pages (Apr. 1976) SD Catalog No. C13.46:680, 50 cents.

Measurement Science and Technology: Policy and State-of-the-art Surveys

Kulin, G., and Gurewitz, P. H., Eds., *Hydraulic Research in the United States and Canada, 1974*, Nat. Bur. Stand. (U.S.), Spec. Publ. 443, 359 pages (June 1976) SD Catalog No. C13.10:443, $4.15.

Risely, A. S., *The National Measurement System for Time and Frequency*, Nat. Bur. Stand. (U.S.), Spec. Publ. 445-1, 72 pages (June 1976) SD Catalog No. C13.10:445-1, $1.20.

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Morris, M. C., McMurdie, H. F., Evans, E. H., Paretzkin, B., de Groot, J. H., Hubbard, C. R., and Carmel, S. J., *Standard X-ray Diffraction Powder Patterns. Section 13-Data for 58 Substances*, Nat. Bur. Stand. (U.S.), Monogr. 25-Sec. 13, 114 pages (June 1976) SD Catalog No. C13.44:25/Sec. 13, $1.80.

Standard Reference Data

Allen, A. O., *Drift Mobilities and Conduction Band Energies of Excess Electrons in Dielectric Liquids*, Nat. Stand. Ref. Data Ser., Nat. Bur. Stand. (U.S.), 58, 23 pages (May 1976) SD Catalog No. C13.48:58, 70 cents.

Moore, C. E., *Selected Tables of Atomic Spectra. Atomic Energy Levels—Second Edition. B: Multiplet Tables. O_I*, Nat. Stand. Ref. Data. Ser., Nat. Bur. Stand. (U.S.), 3, Sec. 7, 30 pages (Apr. 1976) SD Catalog No. C13.48:3/Sec. 7, 85 cents.

Publications listed here may be purchased at the listed price from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (foreign: add 25%). Microfiche copies are available from the National Technical Information Service, Springfield, Va. 22151. For more complete periodic listings of all scientific papers and articles produced by NBS staff, write: Editor, Publications Newsletter, Administration Building, National Bureau of Standards, Washington, D.C. 20234.

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